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(54) Television Receivers with Enhanced Sound

(57) A television receiver is provided with at least two differently-directed loudspeakers (20, 22) and with means (40, 42) for deriving from a received television signal at least two sound signals for application respectively to different ones of the loudspeakers, one being a main sound signal and the other an auxiliary sound signal. There may be two loudspeakers one (20) of which is directed forwardly of the receiver and the other (22) of which is directed rearwardly into the corner of a room. The front loudspeaker (20) is fed by conventional sound circuits (40) with a normal monophonic sound signal. The rear loudspeaker (22) is fed with a modified sound signal derived by processing the normal mono signal in a band limiter (44), a delay (46) and an amplifier (48) to increase the gain. Alternative possibilities for the arrangement of the loudspeakers and the signals applied to them are described.

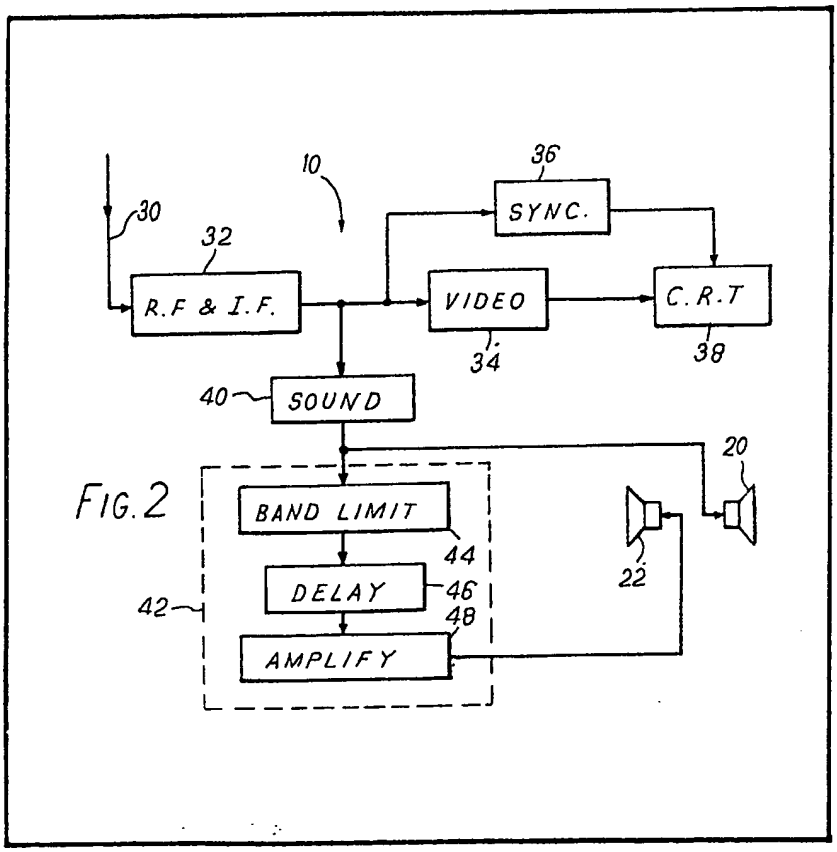

FIG. 2

The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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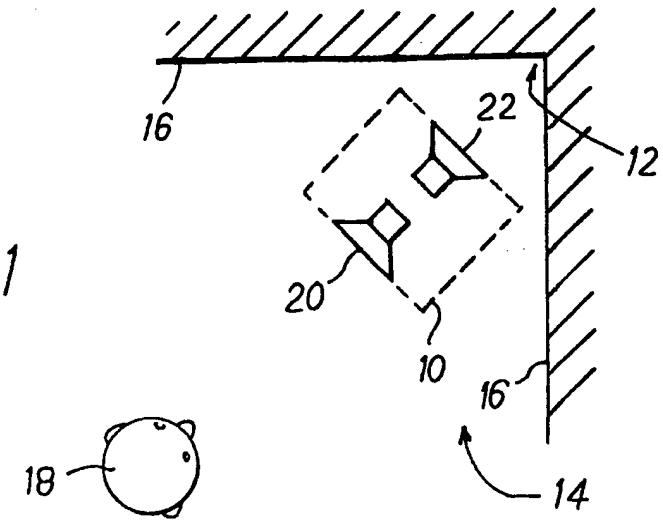

FIG. 1

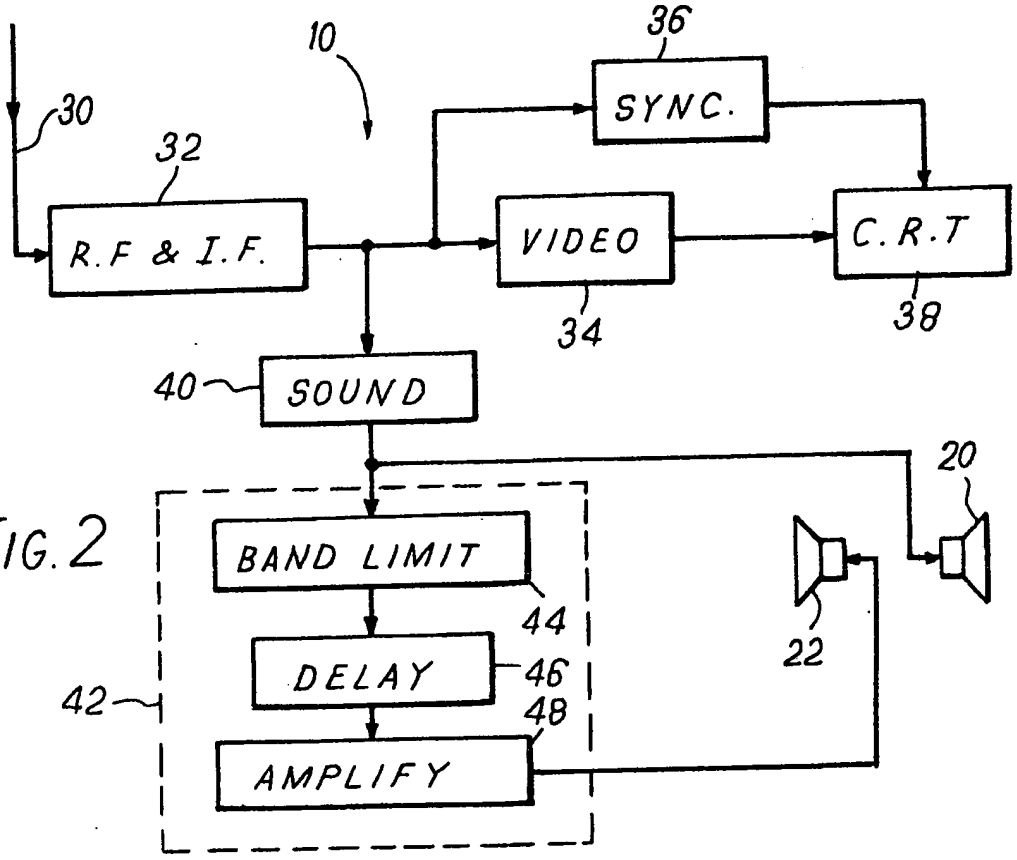

FIG. 2

SPECIFICATION

Television Receivers with Enhanced Sound

This invention relates to television receivers, and is concerned to provide enhancement to the normal sound reproduction of the receivers.

The invention is defined in the appended claims, to which reference should be made.

The invention will be described by way of example with reference to the drawing, in which:—

Fig. 1 is a diagrammatic plan view of a television receiver embodying the invention and positioned in a room; and

Fig. 2 is a schematic block diagram of the receiver circuitry.

Fig. 1 shows a television receiver 10 positioned at an angle across the corner 12 of a room 14, part of the two adjacent walls 16 being shown. The walls preferably have a hard surface. The receiver has its cathode ray tube (C.R.T.) screen facing outwardly from the corner into the room and can be viewed by a viewer 18. The receiver has a main loudspeaker 20 facing in the same direction as the screen, and an auxiliary loudspeaker 22 facing in a different direction, namely rearwardly of the receiver and into the corner 12 of the room.

We propose feeding a main sound signal to the main, forward-facing loudspeaker 20 of such an arrangement, and an auxiliary sound signal to the auxiliary, rearwardly-facing loudspeaker 22. The intention is to enhance the normal monophonic (mono) signal with "ambience" signals. With the arrangement of Fig. 1 these ambience sounds are directed into the corner of the room, and it is anticipated that reflections from the walls 16 will then spread the ambience sound throughout the room, whilst direct mono sound comes from the front loudspeaker.

Various signal possibilities have been considered, and three will be described. These have been tested using a 4-track tape recorder carrying four discrete quadrophonic signals L_F, R_F, L_B and R_B representative of left and right, front and back information. From these the following signals were derived:

$$\begin{aligned} \text{Mono} &= L_F+R_F+L_B+R_B \\ \text{L (left)} &= L_F+L_B \\ \text{R (right)} &= R_F+R_B \\ \text{F (front)} &= L_F+R_F \\ \text{B (back)} &= L_B+R_B \end{aligned}$$

The first system considered involved applying the front signal F to the front loudspeaker 20 and the rear signal B to the rear loudspeaker 22. This system appeared to give a small amount of enhancement over a normal receiver. The sound tended to be more diffuse, and appeared to come from an area around the front loudspeaker. The effect seemed to be virtually independent of the listener's position within the room.

However, this system requires the transmission of a second sound signal in the television channel. The second system to be described, which is the system presently preferred, does not have such a requirement and can be used with existing conventional broadcast television transmissions, which include a monophonic sound signal. A receiver adapted in accordance with this system is illustrated in Fig. 2.

Referring to Fig. 2, the receiver 10 is connected to an aerial 30 and includes radio frequency (R.F.) and intermediate frequency (I.F.) circuits 32, video circuits 34, synchronising and scanning circuits 36, a C.R.T. display 38, and sound circuits 40, all of which are entirely conventional. The sound signal from the sound circuits 40 is the normal mono television sound and is applied to the front loudspeaker 20. This same mono signal is also applied to processing circuits 42 which modify the normal sound signal to give a modified sound signal which is fed to the rear loudspeaker 22.

The additional processing circuitry 42 consists essentially of three components; a band pass filter 44, a delay 46, and an amplifier 48. In this way the normal signal is band limited, delayed, and has its gain increased to form the modified signal. It will be appreciated that the order in which the components of the processing circuitry 42 is connected is of little importance, though the arrangement shown is preferred.

The preferred characteristics of the processing circuitry 42 are as follows:

Band-pass filter—lower frequency:	300 Hz
—upper frequency:	5000 Hz
—roll-off	6 dB/octave
Delay:	25 ms
Amplifier gain:	12 dB

The performance of this system was considered better than that of the first system. The delay was found to be highly desirable to obtain a reverberant effect. It may also be an advantage to apply some equalisation to the signal applied to the front loudspeaker when the rear loudspeaker is switched

in. This involves the use of a suitable filter in the signal path to the front loudspeaker so as to correct for any change in the tonal quality of the overall sound that may occur when the rear loudspeaker is on, as compared with the condition when only the front loudspeaker is on.

Possible ranges of values for the components of the processing circuitry 42 are as follows:

Band-pass filter—lower frequency:	200 to 600 Hz
—upper frequency:	2000 to 8000 Hz
Delay:	5 to 50 ms
Amplifier gain:	5 to 20 dB

These ranges represent the best broad estimates we have been able to make, but in view of the subjective nature of the results, variations in the ranges and preferred values are possible.

In the third system the same processing circuitry 42 of Fig. 2 is used, but instead it receives a second, separate sound signal in the form of a stereo-difference signal L—R. This signal is the left minus right signal of normal F.M. stereo broadcasts, or the left-channel signal minus the right-channel signal of normal stereo discs and tapes. The normal mono or L+R signal is applied to the front loudspeaker. In this case, the delay 46 is not essential, but is should provide some improvement and be found desirable. With no delay in the circuit, the effect given was similar to that of the first system described above, but tended to be less reverberant on some programme material, and was possibly slightly less effective than the first system in enhancing the audio effect.

In the examples described, both the loudspeakers are shown as being in the same cabinet which is also the cabinet of the television receiver. Alternatively, however, the loudspeakers could be in separate cabinets arranged back-to-back. In either case, the subjectively best results are likely to be given with the pair of loudspeakers so placed that the rear loudspeaker points into a corner. Some improvement may also be given, however, if it points at a flat wall.

The arrangements described use two loudspeakers. However, it may prove desirable to include more than two loudspeakers, in particular there may be one main and two auxiliary loudspeakers, the latter receiving the same or different signals. When the loudspeakers are all in the same cabinet, it is anticipated that the auxiliary loudspeakers will normally be directed in a direction which is relatively more rearwardly than that of the receiver viewing screen and the main front loudspeaker. However, it may be desirable to direct the auxiliary loudspeaker(s) at an angle to the horizontal plane.

While some audio enhancement has been obtained with the arrangements illustrated, it is not contended that this enhancement is particularly great. Furthermore, it is only effective with a relatively small proportion of normal programme material. Nevertheless, the results obtained may provide enhanced listening for certain viewers, particularly for programmes with music or audience reaction (e.g. from a studio audience).

Claims

1. A television receiver, provided with at least two differently-directed loudspeakers, and with means for deriving from a received television signal at least a main sound signal and an auxiliary sound signal for application respectively to different ones of the loudspeakers.

2. A television receiver according to claim 1, in which the said means provides a normal monophonic sound signal from the received television signal and a modified sound signal from the normal sound signal.

3. A television receiver according to claim 2, in which the modified signal is derived from the normal signal by processing circuitry which includes band limiting means.

4. A television receiver according to claim 2 or 3, in which the modified signal is derived from the normal signal by processing circuitry which includes delay means.

5. A television receiver according to claim 2, 3 or 4, in which the modified signal is derived from the normal signal by processing circuitry which includes amplifying means.

6. A television receiver according to any of claims 1 to 5, in which one loudspeaker is directed in generally the same direction as the receiver viewing screen.

7. A television receiver according to any of claims 1 to 6, in which one loudspeaker is directed rearwardly of the receiver viewing screen.

8. A television receiver according to any of claims 1 to 6, in which one loudspeaker is directed in generally the opposite direction to the receiver viewing screen.

9. A television receiver according to any of claims 1 to 8, in which at least two loudspeakers are housed in the cabinet containing the receiver viewing screen.

10. A television receiver according to any of claims 1 to 8, in which all the loudspeakers are housed in the cabinet containing the receiver viewing screen.

11. A television receiver substantially as herein described with reference to the drawing.

12. The use of a television receiver in accordance with any preceding claim, with the receiver facing outwardly from the corner of a room.

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